First record of three species of octopodidae and gonatidae, cephalopods in the East/Japan Sea

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Abstract: Three species of the unrecorded octopus and squids, Octopus megalops, Berryteuthis magister and Gonatopsis makko were collected for the first time from the East/Japan Sea in June, 2005. New Korean names proposed for these three species are ‘Big-eye octopus, Makogonate squid, Schoolmater gonate squid’ for the O. megalops, B. magister and G. makko, respectively. We report detailed taxonomic descriptions of these species.

Key words: Octopus megalops, Berryteuthis magister, Gonatopsis makko, First record, East/Japan Sea

Introduction

The preliminary lists of cephalopods from the East/Japan Sea, including Korean waters, were compiled by Yamamoto and Ishito (1942) and Nishimura (1968). More detailed lists of the cephalopods fauna from the East/Japan Sea were later reported by Roper et al. (1984) and Nesis (1987), who summarized the geographical distribution and diagnostic features of cephalopods in the world. The cephalopods of Korean waters were studied and compiled by Jae et al. (1990), who summarized the biology and morphological characters of the 29 species.

The East/Japan Sea is relatively deep sea, with a maximum and mean depth of 4,000 m and 1,700 m. In this study area, water temperatures and salinity ranged 0.1-1.0°C and 34.06-34.08 respectively from April to October (NFRDI, 2005, 2006). B. magister and G. makko live in midwater, mainly mesopelagic and bathypelagic, rarely epipelagic or near bottom in the bathyal. Found in temperature and cold waters of both hemispheres, most richly represented in the boreal Pacific. They play an important role in the food of marine vertebrates and are of minor fisheries value (Nesis, 1987). O. megalops is benthic animal from the littoral to abyssal (Okutani, 1995).

The genus Octopus of the family Octopodidae, comprising approximately 90 species, inhabit sublittoral and bathyal areas of the ocean, except the Artic and Antarctic (Nesis, 1987). Most octopuses of the family Octopodidae are benthic. They inhabit throughout the world from shallow coastal areas to deep waters of at least 1,000 m depth (Roper et al., 1984). The genus Berryteuthis and Gonatopsis of the family Gonatidae include 2 and 5 species, respectively, in the north Pacific (Nesis, 1987). These squids of the family Gonatidae are mainly mesopelagic and bathypelagic, and are rarely epipelagic in deep waters. They are found in temperate and polar areas, and are most abundant in the boreal Pacific area. They play an important role as a food source for marine vertebrates (Okutani, 1995). The commander squid, B. magister have been studied with respect to their age and growth (Natsukari et al., 1993), and their genetic variations (Katugin, 1993). Katugin (2000) reported new subspecies of the schoolmater gonate squid. Their maturation was studied by Okiyama (1993), spawning evidence by Okutani (1988) and distribution by Yuuki and Kita (1986).

While collecting the cephalopod fauna from the East/Japan Sea, we identified three cephalopod species that have not yet been reported: O. megalops, B. magister and G. makko. We describe their morphological features with taxonomical remarks.

Materials and Methods

Specimens of three species, O. megalops, B. magister and G. makko were collected in June 2005 by a bottom trawl of RN Tamgi 1, the National Fisheries Research and Development Institute (NFRDI) from the area known as the Korean Fisheries Blocks, 71 and 72 (37°00’-37°30’N, 130°00’-131°00’E) in the East/Japan (Fig. 1). The net with otter boards was towed in 300-900 m depth bottom during the daytime for 60 min at 3-4 knot and reached layers of. All specimens were measured in total length (TL), mantle length (ML), mantle width (MW), fin width (FW) and total weight (TW). Taxonomical and morphometric characters of specimens were identified following Nesis (1987) and Okutani et al. (1987). The specimen were deposited in NFRDI, Busan.

Results and Discussion

Suborder: Incirrrata Grimpe, 1916
Family: Octopodidae Orbigny, 1845
Genus: Octopus Lamarck, 1798
(Korean name : Mun-eo-sok)
Octopus megalops Taki, 1964
(Korean name : Nun-keun-nae-ji) (Fig. 2)
Paraoctopus megalops Okutani et al., 1987, 173, Pl. 172, Figs. A-C, Tosa, Japan.

Materials: NFRDIP #050601 (56 specimens), 23.8-56.1 cm TL, Korean Fisheries Blocks 71 (130°25’55”E, 37°15’30”N) at 300 m depth in the East/Japan Sea, June 8, 2005.
Mantle length (cm)  6.0 ( 3.4 - 9.0)  3.8 - 5.8
Table - 2:
Table - 3:
Sucker (pairs)  65 (50 - 79)  50 - 85

FW/ML (% )  45 - 47  45-50 less than 50
Mantle length (cm)  21.2 - 23.4 - -
FL/ML (%)  55 - 56  55 - 56 more than 55

Description: Morphometric characters are shown in Table 1. The body is soft and the mantle surface is smooth. ML is almost the same as MW, or slightly wider than TL. The mantle opening extends to the middle of the body, ending at the postero-ventral corner of the eye. The head is bispherical with the huge eyes, and demarcated from both mantle and arm by weak constrictions. The funnel is moderate, with a W-shaped funnel organ. The umbrellas are usually continuous to lateral webs along each arm. Arms are rather muscular, with the formula, I>II=III>IV. The ligula is slenderly conical with a narrow groove. The calamus is small and conical with rather shallow spermatophoric groove. Suckers are biserial. The left arms of the male is hectocotylized. There are 50-80 pairs of suckers in small individuals, but 80-85 pairs in large individuals.

Distribution: Tosa Bay and the Sea of Enshu-Nada, Japan, 100-300 m depth (Okutani et al., 1987), East Japan Sea (The present study).

Remarks: *O. megalops* is similar to *O. tenuicirrus* in their morphology, but differs in having entirely smooth skin, a single suprocular and smaller number of gill leaflets (Okutani et al., 1987). *Octopus megalops* is unique in having a huge eyes and smooth mantle surface. Morphometric characters of the present specimen from the East Japan Sea corresponded closely to those given in the previous descriptions *O. megalops* (Okutani et al., 1987). However, the present specimen differed from those of Okutani et al. (1987) in the total length range (23.8-56.1 cm vs 15.7-33.0 cm), mantle length range (3.4-9.0 cm vs 3.8-5.8 cm), showing a possibility of regional variation. Therefore, it is necessary to study more specimens of the

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Table - 1: Counts and measurements of *Octopus megalops*

<table>
<thead>
<tr>
<th>Characters</th>
<th>The present study</th>
<th>Okutani et al. (1987)</th>
<th>Roper et al. (1984)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of individuals</td>
<td>56</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total length (cm)</td>
<td>36.5 (23.8 - 56.1)</td>
<td>15.7 - 33.0</td>
<td></td>
</tr>
<tr>
<td>Total weight (g)</td>
<td>17.3 (6.2 - 44.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mantle length (cm)</td>
<td>6.0 (3.4 - 8.0)</td>
<td>3.8 - 5.8</td>
<td></td>
</tr>
<tr>
<td>Arm formula</td>
<td>I&gt;II&gt;III&gt;IV</td>
<td>I&gt;II&gt;III&gt;IV, I&gt;II&gt;III&gt;IV</td>
<td></td>
</tr>
<tr>
<td>Sucker (pairs)</td>
<td>65 (50 - 79)</td>
<td>50 - 85</td>
<td></td>
</tr>
</tbody>
</table>

Table - 2: Counts measurements of *Berryteuthis magister*

<table>
<thead>
<tr>
<th>Characters</th>
<th>The present study</th>
<th>Okutani et al. (1987)</th>
<th>Roper et al. (1984)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of individuals</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Mantle length (cm)</td>
<td>31.9 - 32.4</td>
<td>22.0 - 32.4</td>
<td></td>
</tr>
<tr>
<td>Total weight (g)</td>
<td>198.9 - 218.8</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Arm formula</td>
<td>III=II&gt;I&gt;IV</td>
<td>III=II&gt;I&gt;IV</td>
<td></td>
</tr>
<tr>
<td>FL/ML (%)</td>
<td>55 - 56</td>
<td>55 - 56</td>
<td></td>
</tr>
<tr>
<td>FW/ML</td>
<td>76 - 78</td>
<td>75 - 80</td>
<td></td>
</tr>
<tr>
<td>MW/ML</td>
<td>-</td>
<td>35 - 37</td>
<td></td>
</tr>
<tr>
<td>Tentacle length/ML (%)</td>
<td>128 - 130</td>
<td>120 - 160</td>
<td></td>
</tr>
</tbody>
</table>

Table - 3: Counts measurements of *Gonatopsis makko*

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Number of individuals</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Mantle length (cm)</td>
<td>21.2 - 23.4</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FL/ML (%)</td>
<td>27 - 30</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>FW/ML (%)</td>
<td>45 - 47</td>
<td>45-50 less than 50</td>
<td></td>
</tr>
<tr>
<td>MW/ML (%)</td>
<td>19 - 21</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
species from various areas in order to clarify regional variation. Abundance in number of individuals and in total weight of *O. megalops* were 52 inds. and 18,586 g respectively at Korean Fisheries Blocks 71.

**Suborder**: Oegopsida Orbigny, 1845  
**Family**: Gonatidae  
(Korean name: Gar-go-ri-o-jing-eo-kwa)  
**Genus**: *Berryteuthis* Naef, 1921  
(Korean name: Huin-gar-go-ri-o-jing-eo-sok)  
**Berryteuthis magister** (Berry, 1913)  
(Korean name: Huin-gar-go-ri-o-jing-eo) (Fig. 3)

*Berryteuthis magister* Nesis, 1987, 198, Figs. A-B; Okutani et al., 1987, 131, Pl. 130, Kayabe, Hokkaido, Japan; Okutani, 1995, 95, Pl. 36 142A, Hokkaido, Japan; Roper et al. 1984, 143.  
*Gonatus magister* Berry, 1913, 75, Hawaii, USA.  
*Gonatus septemdentatus* Sasaki, 1916, 110, Japan.

**Materials**: NRFDICP #050602 (2 specimens), 31.9-32.4 cm ML, Korean Fisheries Block 72 (130°48′00″E, 37°28′30″N) at 900 m depth in the East/Japan Sea, June 10, 2005.

**Description**: Morphometric characters are given in Table 2. This species exceed 30 cm ML. The body is the typical teuthoid. The mantle is cylindrical with soft muscle. The fins are broadly sagittate, with straight anterior and posterior margins. The antero-dorsal margin is bluntly triangular, while the ventral margin is slightly concave with blunt lateral lobes. FL is 55-56% of ML and FW is 76-78% of ML. The head is cubic, with large lateral eyes. The anterior lobe of the orbit is thickened. The arms are muscular with the formula III>II>IV. Tentacle is relatively strong, 128-130% of ML.

**Distribution**: North Pacific, Southern Japan, Kurile Islands, from Aleutian Islands to northwestern USA (Roper et al., 1984), East/Japan Sea (The present study).

**Remarks**: Okutani (1995) described that although it closely resembles *B. magister* and *B. magister nipponensis* in their morphology, *B. magister* differs from the former in having soft muscle, larger fins and much remarkably enlarged suckers in tentacle manus. Okutani et al. (1987) reported *B. magister nipponensis* was a subspecies of *B. magister* in the East/Japan Sea. Morphometric characters of the present specimen from the East/Japan Sea corresponded closely to those given in the previous descriptions *B. magister* (Okutani et al., 1987; Roper et al., 1984). The body of *B. magister* is typical teuthoid. The muscle is large, robust cylinder with rather soft muscle. The tentacles are long and expanded clubs. Abundance in number of individuals and in total weight of *B.*
**Distribution:** North Pacific, from the Japanese waters to the Bering Sea (except the Sea of Okhotsk) eastern and northwestern coasts of North America (Roper et al., 1984), East Japan Sea (The present study).

**Remarks:** Morphometric characters of the present specimen from the East Japan Sea corresponded closely to those given in the previous descriptions *G. makko* (Roper et al., 1984; Nesis, 1987). *G. makko* is very similar to *Totarodes pacificus* in their morphology, but differs in having flabby muscle, smaller fins, arm hook and no tentacles. Abundance in number of individuals and in total weight of *G. makko* were 3 inds. and 272 g respectively at Korean Fisheries Blocks 72.

**Acknowledgments**

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**References**


